

Automated Multiphasic Health Testing

ANNA C. GELMAN, M.P.H.

RAPID growth in medical care, as a result of expanding governmental programs and technological advances, has created a demand for medical services that far exceeds the present supply of physicians. On December 31, 1967, there were about 260,000 (132 per 100,000 population) non-Federal physicians and osteopaths providing patient care in the United States in office- and hospital-based practice and in hospital training programs (1). Fewer than half of this number were "family practice" physicians; that is, general practitioners, internists, and pediatricians.

National estimated health expenditures were \$56 billion in 1968 and are expected to reach \$80 billion by 1971 (2). The demand for both preventive and therapeutic medical services is increasing, and it is apparent that if this demand is not met, some action will have to be taken to achieve more efficient use of available physicians.

One approach to alleviating the shortage of physicians is to underplay preventive examinations and concentrate on treating only persons with obvious medical complaints. But this way is unfeasible since the practice of regular checkups is ingrained in some segments of our population.

Another approach is to increase the number of physicians. Although 12 new medical schools were opened between 1964 and 1968 and enroll-

ments in all medical schools increased, the number of graduates from these schools within the next few years may not have much impact on the existing ratio of physician to population since the usual period of medical training has been estimated at between 9 to 15 years (3). There is also no way of determining how many graduates will enter "family practice."

If the medical profession is concerned with retaining the position it now maintains in the hierarchy of medical care, it will be compelled to adopt new technological procedures, among which is the automation of some of the routine examinations administered for purposes of diagnosis, preventive care, assessment of physical fitness, and patient management.

A method that has been proposed to achieve efficient use of the physician through technology is automated multiphasic health testing (AMHT). This method can relieve the physician of the physical and laboratory examinations that can be performed by well-trained paramedical or auxiliary health workers under the supervision of professionally qualified persons. About 2.3 million persons in the United States, in addition to more than 1 million physicians, dentists, and registered nurses, have had specialized education or on-the-job training for functioning in the health field (1). Automatic recording devices, biochemical and hematological AutoAnalyzers, sense-marked questionnaires, and data processing devices are all part of the "new look."

Can a wide network of AMHT centers, public and private, be introduced within the existing framework of organized medical care in this country? McNerny has stated that "a 3 percent

Mrs. Gelman is assistant professor of epidemiology at Columbia University School of Public Health and Administrative Medicine, and project director of multiphasic screening, American Health Foundation, New York City.

increase in the productivity of the physician would be equivalent in service of all members of the graduating classes of all medical schools in a given year" (3). Is automated multiphasic health testing one way to achieve this? Investment capital believes that the answer is affirmative and is rapidly moving to "get in on the ground floor." New businesses are being set up, such as Medidata Sciences, Inc., a subsidiary of G. D. Searle Co., which offers to sell or lease automated multitest systems.

Organized medicine, as represented by the American Medical Association, is currently of the opinion that "automated multiphasic screening at this point in time is a promising technique which requires further experimentation and controlled evaluation to fully identify its benefits, limitations, and ultimate potential" (4).

The American Public Health Association is of the opinion that "comprehensive multiphasic screening programs of the type recommended require careful detailed planning and coordination. Time and effort must be spent to survey existing programs; past histories of different programs; existing community needs, services, and resources; the cost, value, and feasibility of various tests; and to sample the attitudes and desires of the target populations and the medical community concerning a screening program. Only after this basic work has been completed can an effective program be tailored to the specific community concerned" (5).

The conflicting convictions of interested private enterprise on the one hand and representatives of the medical and public health professions on the other hand have raised many questions concerning AMHT. Foremost among these are:

1. Why is the concept of presymptomatic examinations treated as a new development if the periodic health examination has been an acceptable procedure since the early part of this century?

2. Is the application of AMHT limited to the "screening" of healthy persons for presymptomatic disease?

State of the Art of AMHT

"State of the art" may be interpreted in a variety of ways, depending on the interests of the persons using the expression. As used by the

bioengineer and instrument designer, it refers to the development stage of the testing devices used in the system. The entrepreneur, on the other hand, is concerned with whether or not the system can be marketed. Industries like the data processing companies are looking for fresh outlets for their services. Instrument manufacturers are concerned with the development and production of more acceptable competitive instrumentation. Pharmaceutical companies are interested in expanding their biochemical and other testing services and operations. Systems designers are concerned with the market for entire coordinated systems. Architectural firms are interested in the design of stationary centers and mobile units.

All of this activity culminates in the sale of facilities, equipment, and services to interested groups, whether they comprise hospitals, medical groups, physicians in solo practice, unions, industrial medical departments, governmental agencies, or anyone interested in purchasing such products or services.

Epidemiologists, geneticists, biostatisticians, social scientists, sociologists, and health planners, among others, are concerned with the ability of this system to supply them with valid and significant data relating to variables associated with health and disease. Educators, psychologists, hospital administrators, technicians, and biochemists think of the system in terms of whether it will create new opportunities or threaten the status quo.

Federal, State, and local governments are usually concerned with the validity, reliability, cost-benefit ratios, and legality of the various components of the system in order to protect the individual consumer toward whom all of this is directed. Such agencies as the Armed Forces also are concerned with the applicability of the system in mass examinations of persons under their jurisdiction.

Consumers, represented by consumer groups such as unions, are concerned with evidence that the system will benefit them. Employers are more interested in knowing whether the use of such a system will reduce absenteeism and medical costs and increase production.

The insurance industry, to determine future involvement in paying for testing procedures, is interested in how the system may affect dis-

ability and hospital claims as well as the longevity of clients. Few insurance policies provide for preventive examinations. Only the large closed-group-practice prepayment plans provide examinations, physician services, followup, and therapy within a group setting; for example, the Health Insurance Plan of New York City, Permanente Medical Group in Oakland, Calif., and Group Health Association, Inc., in Washington, D.C. A few comprehensive free-choice, fee-for-service plans also apparently have enough subscribers to warrant such a service; for example, Group Health Insurance of New York City. In addition, many large concerns provide or pay for periodic health examinations of their executives and occasionally of other employees. A search of available sources of information on medical insurance in the United States did not reveal any additional insurance plans with preventive examinations for persons without medical complaints. Unless such examinations are requested by a physician as part of the treatment of a patient consulting about a medical problem, they are not reimbursable.

Recent Developments in Health Screening

In 1966 congressional hearings were devoted to the feasibility of providing multiphasic screening for the elderly under Medicare (6). Further hearings were held in 1968 (7). A bill to amend the Public Health Service Act to an Adult Protection Act has been repeatedly introduced in the Senate. This bill includes a provision for "health appraisal and disease detection services on a periodic basis."

The Head Start Program guide (8), which includes standards for the examination of 2- and 3-year-olds, has an entire section devoted to screening. A Medicaid regulation, effective July 1, 1969, requires the States to provide periodic health screening, diagnosis, and treatment for all eligible youths under 21 years of age.

The National Center for Health Services Research and Development is partially supporting four community-type AMHT projects for adults (Brookdale Hospital Center Multiphasic Screening Clinic, Brooklyn, N.Y., Tulane Health Maintenance Project, New Orleans, La., Milwaukee (Wis.) Health Department Adult Health Appraisal Program, and Rhode Island

State Department of Health and Rhode Island Hospital Multiphasic Screening Program, Providence) as well as a research program at the Permanente Medical Group (9), which has been developing and using a system for a number of years.

The Public Health Service has, within recent years, issued special publications directly related to screening and periodic health examinations (10, 11). Dr. M. J. Keyes, in a letter dated January 27, 1970, stated that the Regional Medical Programs are currently funding multiphasic screening programs at Roseville, Calif., Gainesville, Fla., Indianapolis, Ind., Rochester, N.Y., and Mid-South-Nashville, Tenn. The directory of the Regional Medical Programs includes a number of other approved programs that involve screening of selected population groups.

On June 23, 1969, the first meeting of the Policy Advisory Committee on Multiphasic Testing (Screening) of the U.S. Department of Health, Education, and Welfare was held to consider the problems of multiphasic screening. On January 21-23, 1970, this committee convened an invitational meeting to consider provisional guidelines for automated multiphasic health testing and service because of the growing need and demand for such guidelines.

Black (12), at Fort Ord, Calif., is studying the value of screening Army recruits. The Army is also in the process of selecting an AMHT system design for a demonstration project. The Health Services Research Branch of the Federal Health Programs Service has completed a systems design for a health evaluation (multiphasic screening) center (13), which is being integrated into the inpatient and outpatient services of the Baltimore Public Health Service Hospital. Installation was expected by December 1969. The medical departments of some industries (for instance, International Business Machines), have initiated the system for their employees.

Periodic Health Examinations

As conducted by the personal physician. This examination is generally conducted by the physician in his office. It may also be administered in a medical group practice in which the person to be examined has a personal physician.

The examination usually is performed at the discretion of the personal physician and may relate to his knowledge of the patient and the time that has elapsed since the patient's last visit.

Ideally, every person would consult his personal physician annually for a thorough physical examination. The physician would have a modern, fully equipped office with qualified technical staff as well as facilities for followup. However, there are not enough general practitioners, internists, and pediatricians available for such examinations. If all 260,000 licensed physicians in the United States, regardless of specialty, were to assume the responsibility for annual physical examinations, each physician would have to perform approximately three a day. Based on the estimate of approximately 60 to 65 "family service" physicians per 100,000 population available for diagnostic services, each would have to perform roughly seven physical examinations a day if all 200 million of the population were examined annually. Who then would treat the sick?

As conducted in a private medical diagnostic center. This examination ideally consists of physical examination and evaluation by a physician who is not the examinee's personal physician. In addition to private medical diagnostic centers, diagnostic services of hospitals and medical departments in industry may conduct such examinations. In these examinations, the physician "lays hands on" the examinee. The screening examinations usually follow a prescribed set of procedures, varied only by the cost of the examination and the age and sex of the patient. (See tests and measurements.)

The results either are given directly to the examinee with the recommendation that he visit his personal physician or are sent to the personal physician designated by the patient. The periodicity of the examination is dependent on the interest of the patient, who is advised to return.

The continued existence of private medical diagnostic centers since they were first established in 1914 indicates that the medical profession has found the system to be acceptable. Such centers cater to persons directed by employers (executive health) or personal physicians or to those sufficiently interested in their

own health to pay the fee. The public does not generally utilize them owing to ignorance of their existence, lack of interest, geographic location, or cost of examination. For instance, the fee schedule for typical examinations in New York City is as follows:

<i>Private examination in a diagnostic center</i>	<i>Fee</i>
Standard executive, plus Papanicolaou smear (\$10)	\$110
Senior executive.....	140
Comprehensive executive.....	180

Comparing the battery of tests and examinations performed by some screening centers, medical diagnostic centers, industrial medical departments, and government-sponsored programs one finds that the variety of tests offered usually are determined by cost, available equipment, interest of persons conducting the program, and perhaps acceptance by the patient. Persons invited or directed to get a "physical" may therefore be subjected to a wide variety of tests ranging from a brief examination in which no clothing is removed to an extensive workup in a diagnostic center of a world-renowned hospital. Sometimes the tests are automated and sometimes they are performed manually. Primarily they are aimed at the older adult. (See tests and measurements.) Because a constant flow of patients is required to keep such organizations viable, the examination groups are usually concentrated in large medical centers or in well-populated urban areas.

Special Multiphasic Screening Programs

Multiphasic screening is an extension of the mass screening technique and was first proposed around 1947 (14). It was enthusiastically received as a means of administering more than one test to persons recruited for mass screening and was sponsored primarily by local agencies on a one-time basis. For one reason or another, although such programs are still being conducted they did not proliferate. Among the reasons given for the apparent lack of popularity were the following: (a) lack of enthusiasm of the medical profession, hence lack of follow-up; (b) many persons are psychologically unprepared to be examined when they are not ill; (c) false positive results may cause hypochondria; (d) false negative results may cause a

false sense of security; (e) the procedure is expensive and government is not in a position to underwrite the cost; (f) the value of the examination is in doubt—that is, the interpretation of minor physiological and biochemical abnormalities in asymptomatic persons; and (g) the value of treating suspected chronic conditions manifested only by a biochemical or physiological abnormality with no symptoms or history of disease is questioned.

Some screening programs can be considered as special purpose programs (15) that concentrate on a group of related diseases like diabetes and the cardiovascular diseases. In these programs, the tests are usually selected to fit the particular objective of the program. Some tests usually included in the periodic examination are omitted if they are not related to the diseases under investigation.

Saving Physician Manpower

Automated multiphasic health testing is an extension of the multiphasic screening concept. The system includes that part of the annual examination or checkup which does not require a physician's "laying on of hands." Many of the common examinations are automatically performed, and the results are automatically recorded. (See tests and measurements.)

The development of hematological and biochemical AutoAnalyzers, automatic audiometric recording, automatic recording of ECG tracings, automated blood pressure apparatus, and other devices have made it possible for these examinations to be performed by well-trained auxiliary workers and professionally qualified nurses and technicians.

Physicians supervise the entire program and perform the examinations and interpretations that only a physician is currently qualified to do; for example, X-ray and ECG interpretations and physical examination when indicated. The final report is sent to the personal physician designated by the patient.

Both the periodic health examination as performed by special medical groups and the periodic AMHT procedures conducted outside the personal physician's office are screening examinations. Diagnosis, interpretation, and followup still remain the responsibility of the personal physician.

In both kinds of examinations, the objective is the same: to detect physiological or biochemical abnormalities that require followup before a diagnosis can be made. They differ only in the extent of physician involvement at the examination center. This difference is being offset by the employment of professional people at some AMHT centers—for example, the Brookdale Hospital Center Multiphasic Screening Clinic utilizes a dentist for oral examinations—and the use of biochemical and hematological AutoAnalyzers by group health examiners.

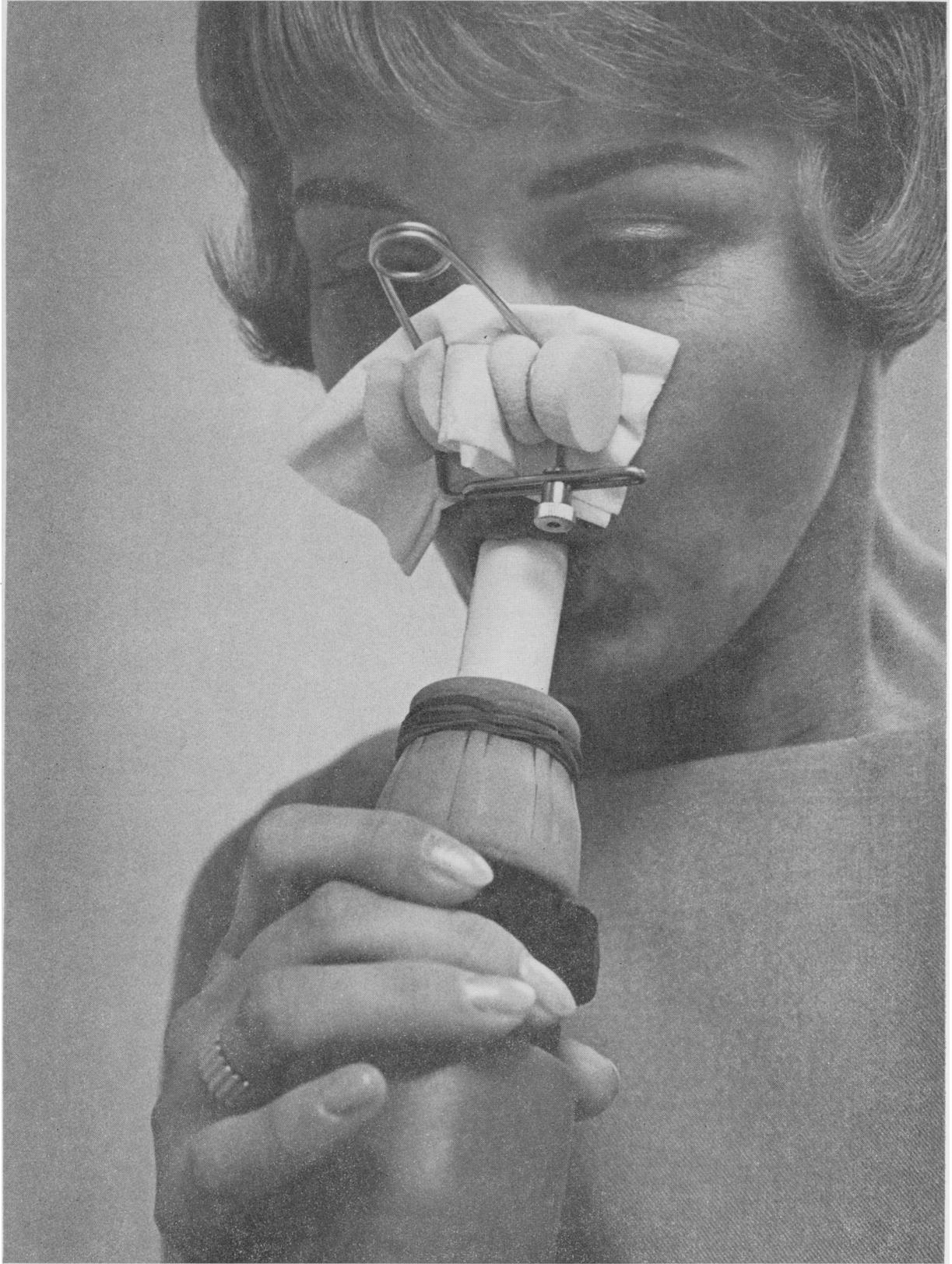
Presumably, a shortage of physicians in medical diagnostic centers curtails the number of examinations that they can perform; therefore, if the popularity of the AMHT centers increases and they are capable of performing examinations at lower cost, the diagnostic centers may be forced to emulate some techniques of the AMHT centers. In the Permanente Medical Group (16), the cost per multiphasic screening, including data processing, was \$21.32 per patient with a workload of 2,000 patients per month. For 1,000 patients, the estimated cost is \$40 to \$50 per examination. If the load were raised to 3,000, the estimated cost could be reduced to \$15 to \$17 per patient.

Value of Periodic Preventive Examination

The belief that it is good practice to visit a physician periodically for a preventive examination is not new. Horace Dobell, lecturing in London in 1861 (17), recommended that examinations including family history, personal and medical histories, advice, and followup for all members of the family would confer "immense benefit upon the public."

Since then there have been a number of advocates of periodic preventive examinations (18, 19), and many physicians and medical groups conduct such examinations. As a result of a 1957-59 survey, the Public Health Service estimated that in 1958 there had been approximately 74 million visits to physicians annually for general checkups, amounting to 8 percent of total physician visits (20). These checkups did not include prenatal and postnatal consultations or visits for immunizations exclusively. Improvements have been made in the methods of performing the tests in the checkup.

Continued on page 370



TESTS AND MEASUREMENTS

The following observations relate to 40 current programs representative of those using multiphasic testing. Forty older programs also were reviewed but were not included.

A comparison between the batteries of tests and examinations performed by some existing screening centers, periodic health examination centers, and demonstration programs reveals that the variety of tests offered appears to be determined by cost, available equipment, interest of persons conducting the program, and other factors such as acceptance by the patient.

Some tests have been automated, and some are performed manually. They are primarily aimed at the older adult.

Questionnaires

Most programs include questionnaires, usually modifications of the Cornell Medical Index, which are self-administered and can be filled out at home. The numbers and types of questions vary and may relate to family history, past medical history, and sociometric and psychometric information or be limited to demographic data. Some use additional questionnaires during the examination.

Respiratory Tests

All programs include the chest X-ray for lung examination. Approximately half include pulmonary function tests (spirometry, left). A few programs include sputum cytology.

Anthropometric Measurement

Most programs include height and weight measurements; some include skinfold (right) and other body measurements.

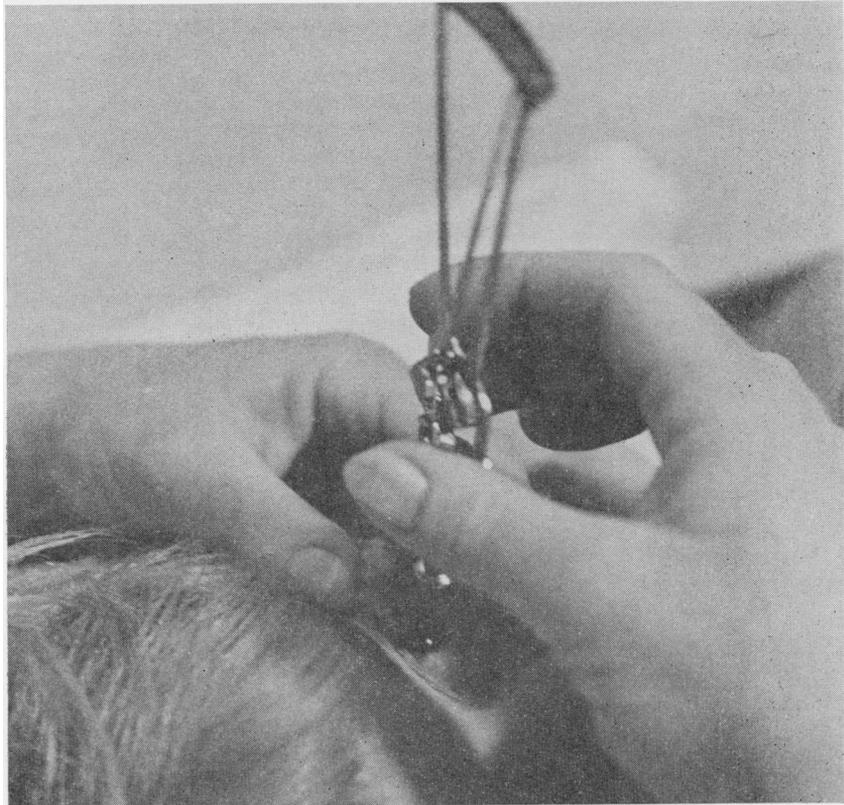
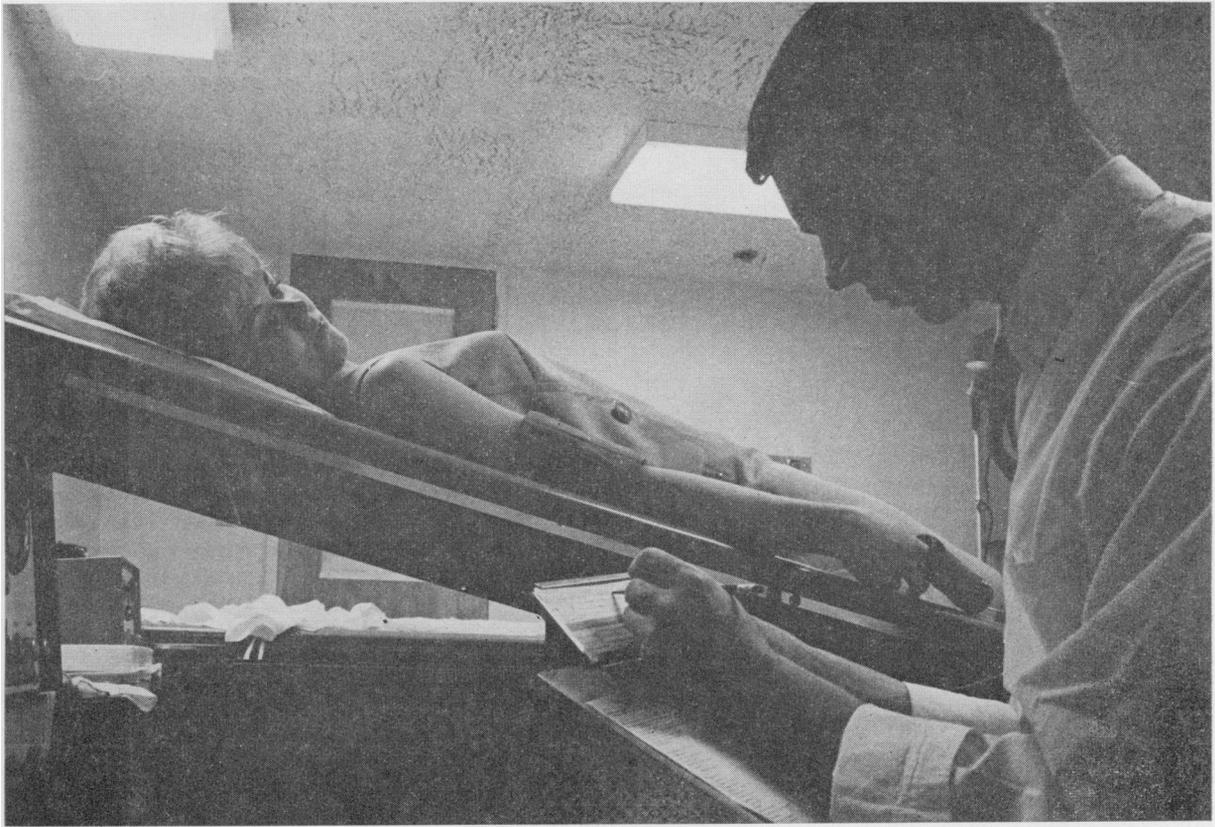
Hearing Examination

About half of the programs include hearing tests.

Hematology

All groups include some hematologic studies. Most perform a white blood cell count and a red blood cell count. Hemoglobin is included by about half, and the hematocrit, by three-fourths





of the programs. Few include blood grouping or test for the Rh factor. Some programs include the mean corpuscular volume, mean corpuscular hemoglobin, and mean hemoglobin concentration measurements. The sedimentation rate appears to be limited to the medical diagnostic centers. One industrial group examines for buffy coat serum color. An occasional group may do a clotting time determination and platelet count or examine for red blood cell sickling.

Cardiovascular Examination

Blood pressure (left, top) is measured by most groups but not always under the same circumstances. Most programs include an electrocardiogram, but the number of leads varies. All include a chest X-ray which is examined for both cardiovascular changes and pulmonary abnormalities. Pulse rate is not universally measured. Vectocardiograms and phonocardiograms occasionally are included.

Visual Acuity and Tonometry

About two-thirds of the programs include a visual acuity examination. Most groups measure ocular pressure (left, bottom). Retinal photography is occasionally performed. Very few programs include a test for color blindness, pupillary reflex, or visual fields.

Cancer Detection

The Papanicolaou smear for cervical cytology is included by most groups, but some limit it to women over a prescribed age. A few centers include a buccal Papanicolaou smear, and a few include sputum cytology. Some form of breast examination, either mammography or self-examination, is recommended but is not yet widely used. Thermography is being tested in at least one center.

Oral and Dental Examinations

A few programs include a pan X-ray, full mouth, and a buccal Papanicolaou smear.

Serology

A serologic test for syphilis is included by about half of the groups, and for the rheumatoid factor by very few.

Blood Chemistry

Approximately 30 different blood chemical analyses can now be performed by an AutoAnalyzer; however the selection of tests to be included in the different programs varies as does the use of the methods of performing the tests; that is, AutoAnalyzers or manually. The minimum number of chemistries for any program is one, glucose. Some include only glucose and cholesterol. To these, some add blood-urea-nitrogen and uric acid. Other tests performed by about half of the programs, especially those with available AutoAnalyzers, may include alkaline phosphatase, albumin, globulin, total bilirubin, calcium, inorganic phosphorus, serum glutamic oxalacetic transaminase, and total protein. In addition, the following tests are available and included by a few programs: acid phosphatase, amylase, beta lipoprotein, creatinine, chlorides, carbon dioxide, direct bilirubin, potassium, protein-bound iron, plasma lipemia, serum iron, serum glutamic pyruvic transaminase, sodium, total iron-binding capacity, thymol turbidity, selected trace metals, total lipids, triglycerides, and zinc sulfate turbidity.

Stool Examination

The only stool examination is for occult blood, and few centers include the test.

Urinalysis

All groups include some type of urinalysis; however, the selection of tests differs. Glucose, protein, and bacteriuria are the most popular; half include ketone and blood tests. Some also include microscopic, acetone, pH, and specific gravity tests.

Other Examinations

Several programs include other examinations; for example, flat X-ray of the abdomen, Achilles heel reflex test, and pain response. Centers performing the periodic health examination usually include a complete physical by a physician and may include proctosigmoidoscopy, gastrointestinal X-ray series, gall bladder X-ray, rectal examination, pelvic examination, and others if indicated.

Time-consuming and costly tests have been restructured by technology.

Existing AMHT centers have not been in operation long enough to evaluate the full impact of early detection of physiological and biochemical abnormalities on health. They are not yet in a position to evaluate their procedures for yield, effectiveness, interpretation, acceptance by both patient and physician, cost and cost benefits, and so forth. There are no available regulatory guidelines for conducting nongovernmental sponsored centers, for quality control and reproducibility of results, or for interpretation of findings and long-term effects on medical demands, use of hospital beds, and patient benefits.

Personal experience and bias of investigators may be the basis for both support and opposition to preventive examinations. Sustainers claim to have sufficient evidence to justify their support. Opponents direct a variety of criticisms against the idea of preventive examinations in general, the usefulness of individual tests inherited and used by many generations of physicians, the danger of overwhelming the busy physician with trivial abnormalities, and the imperfections of automated procedures.

Are preventive examinations of any value? At best the answer cannot be given on cause-and-effect or epidemiologic bases but on the extent of use or popularity of the executive health examination and the annual checkups. The Life Extension Institute, established in 1914, claims to have performed 3 million executive health examinations in its first 50 years, the major proportion for industrial firms. The medical departments of industrial firms also have performed some of their own examinations. During a recent survey of activities of industrial medical departments by a committee of the Industrial Medical Association (21), 508 of 577 plant directors responding stated that they provided such examinations; of these, 317 said they were performed in whole or in part in the plant medical department.

A search of literature failed to reveal more than a few evaluation studies by medical groups or industrial medical departments performing executive health examinations (22, 23). These studies were limited to a description of the special population groups under observation and

dealt with numbers examined, demographic and socioeconomic variables of the examinees, conditions found, and extent of followup, compliance, and outcome. The authors usually concluded that positive benefits were derived from such examinations.

Roberts and associates (24), in a recent publication, compared the mortality experience of men who had been examined at six diagnostic centers with a similar population that had not been examined, and concluded that there was some improvement in mortality among those who had been examined more than once.

Perhaps the availability of automated data processing and instrumentation will make it possible to analyze rapidly the data derived from current AMHT centers so that answers to questions of the American Medical Association, the American Public Health Association, and other groups will be available.

Physical Fitness Appraisals

In some professions and occupations, pre-employment or physical fitness examinations have long been required of persons applying for positions in which the lives of others are involved—airplane pilots, busdrivers, policemen, firemen, and school teachers, among others. Physical examinations are also a requirement for many job placements in hazardous industries. Physical examinations are required of children before they attend school or summer camp. School children also have periodic examinations during the 12 years they spend in primary and secondary schools.

College entrance requirements frequently include a physical examination. Persons applying for life and disability insurance need an examination. The Army administers a pre-induction physical. Persons applying for overseas service, private or governmental, usually must have medical examinations. Athletes are examined before participating in competitive sports, prisoners before incarceration, and so on. Currently, except for children, college students, and probably prisoners, most of these examinations are performed to determine physical fitness and are not followed up by preventive or therapeutic action.

Because of the doubts being raised about the interpretation of findings, is the physical fitness

appraisal or part of it an unnecessary procedure? If so, what part? If not, to conserve the time of the examining physician, that part of the examination which could be automated and performed by paramedical personnel without sacrificing the quality of the examination could be performed at an AMHT center. A byproduct could be followup for detected abnormalities.

Uses in Patient Management

Automated testing can be of invaluable service to the physician and community in patient management. Whenever a battery of tests and examinations is required before a medical examination, the procedure could be administered in a central setting, within a relatively short period of time, by using the services of trained technical personnel and immediately recording the results.

The system could be used for prehospital, prenatal, post natal, presurgery, post surgery, pre-delivery, and post delivery checkups. It also could be used to follow up the effectiveness of treatment for diabetes, cardiovascular diseases, gout, anemia, and obesity, among others. Testing could be programed in such a way that variables like age, sex, occupation, and purpose for which administered would determine the tests that are needed.

Other Possible Uses of the System

If the AMHT system is acceptable as an examination procedure in performing a series of tests, it could be applied to special groups in addition to those mentioned. For example, this system could be a valuable tool in periodic nutrition surveys to detect the physical and biochemical abnormalities of the examinee and then to compare the results before and after therapy. It could be used for preplacement examinations when allocating the aged to nursing homes to determine which facility best meets the needs of the patient. Automated multiphasic health testing could be used to facilitate the efficient use of consultants and rehabilitation facilities. It could be used to assess the deterioration of persons in nursing homes, since admission records would be available. It could also be used in pretrial assessment of a person's health follow-

ing an accident. It could be used to determine the medical needs of persons receiving or applying for government assistance.

Automated multiphasic health testing could serve as a valuable tool in collecting data on the variables related to health and disease that are required in epidemiology and other scientific disciplines. It could be used to acquire baseline and followup data about persons subjected to clinical drug trials. Automated multiphasic health testing in mobile clinics could serve as a guide in delineating the health needs and the need for specialists and other medical workers in sparsely populated and economically underdeveloped areas (25). The small number of physicians and osteopaths in the United States in office-based practice in some specialties dramatically emphasizes this need. According to the Public Health Service (1), on December 1, 1966, there were 394 gastroenterologists, 68 pediatric allergists, 31 pediatric cardiologists, 452 child psychiatrists, and 843 neurologists, among others, in office-based practice in the United States. Most of these specialists probably are based in large urban areas with accessible medical centers.

Economic Benefits

The application of cost-effectiveness and cost-benefit analyses to health programs poses many problems. "Like most methodologies in a state of test and revision, there are bound to be successes and failures as refinements are made in these analyses" (26). Therefore, to expect automated multiphasic health testing to have produced data on cost effectiveness and cost benefits in its relatively short existence is unrealistic. The development of formulas for the application of such analyses to automated multiphasic health testing should prove useful.

Cost-effectiveness analyses can establish which of two or more alternative procedures will provide the most value per dollar spent in terms of the desired result. This decision may require evaluation of a variety of instruments as well as testing procedures that can be used to identify an abnormality.

Cost-benefit analyses can be applied when determining which test to include in a system; for example, to calculate the cost of detecting one new abnormality per number of tests performed

(27). Cost of the test as well as frequency of the abnormality in the study population would be taken into account. To consider a rare disease if the cost were an objective would scarcely rate first priority. The objective of high yield might be accomplished by paying special attention to the distribution of the various chronic diseases, conditions, and disabilities by age, sex, ethnic background, socioeconomic status, and other variables and including only those examinations expected to produce the highest yield (28, 29).

The use of cost-benefit analyses to evaluate the impact of a test or measurement on the morbidity, disability, and mortality from a specific disease or condition in the examined population, in terms of the cost of administering a test or program and the benefits derived, presents a complex problem, especially when applied to long-term disease. The benefits should be defined before such an analysis is attempted. Benefits may be interpreted to mean the lowering of incidence and prevalence of and mortality from the condition, or the economic benefits to be expected such as lowered medical costs, less demand for medical manpower or facilities, less drain on community resources, greater earning power, and productivity of the persons prevented from having the condition. Benefits also could relate to intangibles like prevention of pain, discomfort, and dependence.

Preoccupation with this subject is not new. As early as 1850, Simonds in New Orleans estimated the cost of illness to that city in terms of economic losses due to premature mortality and recommended that funds spent on public health measures to reduce morbidity and mortality would result in increased economic benefits to the community (30, 31).

In order to answer the question of whether automated multiphasic health testing is a system to be recommended for wide application, efforts should be made to ascertain whether it could serve as a useful and effective method of administering that part of the medical checkup which it encompasses, and whether it can provide more comprehensive diagnostic aids to the physician in the management of his patients and of other persons who, whether they are aware of it or not, may require medical attention.

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Tearsheet Requests

Mrs. Anna C. Gelman, Faculty of Medicine, Columbia University School of Public Health and Administrative Medicine, 600 West 168th St., New York, N.Y. 10032

New Emergency Health Services Periodical

A new periodical, *Emergency Health Services Digest*, has been released for distribution to all interested in emergency services.

Published by the Division of Emergency Health Services of the Public Health Service's Health Services and Mental Health Administration, the first issue of the *Digest* contains summaries of 57 articles selected from current professional literature. Each article deals with some aspect of planning, programing, training, or delivery of emergency medical and health services.

In addition to keeping those involved in emergency health care informed on pertinent current literature, the *Digest* provides a key to selected source material for planning and research efforts and furnishes supplementary reading for training courses and programs. Subsequent issues, each with a cumulative index, are planned for semi-annual publication.

The *Digest* is available from the Information Clearinghouse, Public Information Office, Division of Emergency Health Services, Parklawn Building, 5600 Fishers Lane, Rockville, Md. 20852. It may be purchased from the U.S. Government Printing Office, Washington, D.C. 20502, at 40 cents per copy.

Nostrums and Machines of

MEDICAL QUACKERY

AN EXHIBIT AT THE NATIONAL LIBRARY OF MEDICINE

THE BIZARRE MACHINES and devices of "pseudo medicine" and the extravagant advertising posters for patent medicines are featured in an exhibit at the National Library of Medicine in Bethesda, Md., which will be on display till April 24, 1970.

Entitled "Nostrums and Machines of Medical Quackery," the exhibit includes the Violetta, an ignition coil system which its makers claimed "successfully treated 86 ailments" ranging from heart disease to writer's cramp, and the Ocilloclast, touted as the last word in the diagnosis and treatment of hundreds of diseases. The Ocilloclast was the brainchild of Dr. Albert Abrams of San Francisco. Upon his death in 1924 the *Journal of the American Medical Association* dubbed Abrams "the Dean of all 20th Century Charlatans."

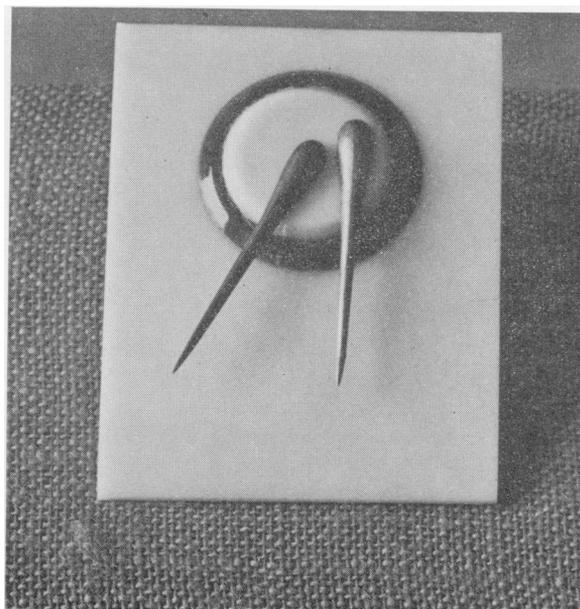
Nostrums in the NLM exhibit are represented by posters and trade cards that promised miraculous cures to users of such preparations as Kickapoo Indian Medicine and Pulmonic Syrup.

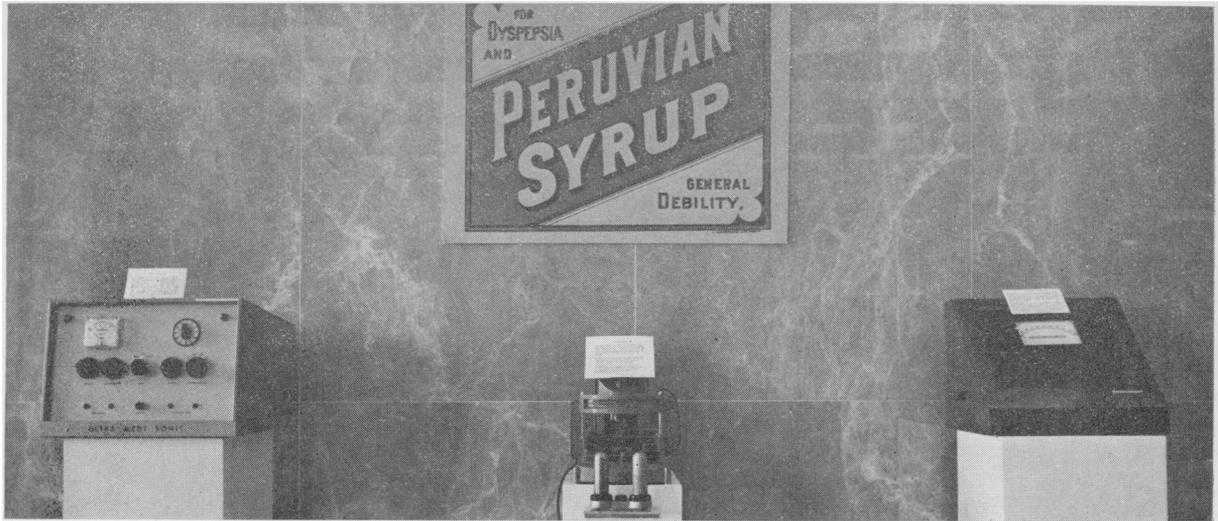
As late as 1957, use of the mails for medical quackery was at the highest level ever. It was estimated that in 1966 quackery cost Americans more than \$2 billion annually.

Gadgets and machines in the exhibit were borrowed from the Smithsonian Institution, California Department of Public Health, American Medical Association, Armed Forces Institute of Pathology Museum, and other sources.

Patent medicine posters are reprinted by courtesy of Gerald Carson. They are from his forthcoming book, "One for a Man, Two for a Horse."

First U.S. patent dealing with therapeutic matters was granted to Elisha Perkins in 1796 for his metallic tractors. The small metal rods were purported to cure when drawn across the body.





Ultra Medi Sonic (left), a 5-tube A.M. radio, sans speaker in a modern cabinet, was claimed to cure conditions such as cancer and emphysema. Micro Dynameter (center) was supposedly able to diagnose scores of diseases by measuring electric currents generated by gripping the metal cylinders. In March 1962 the Court of Appeals at Chicago ruled that the Micro Dynameter was not safe for

use even in the hands of a licensed practitioner. The Neuromicrometer (right), really an ohmmeter, purported to diagnose lung diseases, circulatory disorders, cell exhaustion, inflammations, abnormal kidney functioning, and other ailments. The device was condemned by order of the Court of the Southern District of California in April 1956.

GREATEST DISCOVERIES OF THE 19TH CENTURY

DR. KING'S NEW DISCOVERY THE GREATEST OF ALL FOR SAVING HUMAN LIFE

"The Leaves of the Forest were for the Healing of the Nation"

KA-TON-KA

Is Nature's GIFT to Nature's Children

Seek To the ROOT and the BRANCH, they are LIFE Giving and LIFE Preserving.

We refer you to pages 1287, 1288, 1289, 1290, 1291, 1292, 1293, 1294, 1295, 1296, 1297, 1298, 1299, 1300, 1301, 1302, 1303, 1304, 1305, 1306, 1307, 1308, 1309, 1310, 1311, 1312, 1313, 1314, 1315, 1316, 1317, 1318, 1319, 1320, 1321, 1322, 1323, 1324, 1325, 1326, 1327, 1328, 1329, 1330, 1331, 1332, 1333, 1334, 1335, 1336, 1337, 1338, 1339, 1340, 1341, 1342, 1343, 1344, 1345, 1346, 1347, 1348, 1349, 1350, 1351, 1352, 1353, 1354, 1355, 1356, 1357, 1358, 1359, 1360, 1361, 1362, 1363, 1364, 1365, 1366, 1367, 1368, 1369, 1370, 1371, 1372, 1373, 1374, 1375, 1376, 1377, 1378, 1379, 1380, 1381, 1382, 1383, 1384, 1385, 1386, 1387, 1388, 1389, 1390, 1391, 1392, 1393, 1394, 1395, 1396, 1397, 1398, 1399, 1400, 1401, 1402, 1403, 1404, 1405, 1406, 1407, 1408, 1409, 1410, 1411, 1412, 1413, 1414, 1415, 1416, 1417, 1418, 1419, 1420, 1421, 1422, 1423, 1424, 1425, 1426, 1427, 1428, 1429, 1430, 1431, 1432, 1433, 1434, 1435, 1436, 1437, 1438, 1439, 1440, 1441, 1442, 1443, 1444, 1445, 1446, 1447, 1448, 1449, 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National X-ray Exposure Study

THE PUBLIC HEALTH SERVICE is conducting a national study to obtain information on population exposure to diagnostic and therapeutic X-radiation. It began on April 13, 1970, and is a joint effort of the Bureau of Radiological Health and the National Center for Health Statistics. The study was planned with the advice of a group of radiologists and physicists representing the American College of Radiology.

The study follows two earlier national X-ray surveys by Public Health Service agencies. The first was conducted in 1961 to estimate the volume of medical and dental X-ray visits in the United States. A more comprehensive study was made in 1964 to extend the X-ray visit data to include exposure and dose estimates for the U.S. population in that year.

The 1970 study is using the same collection and analysis methods employed in the 1964 survey so that results of the investigations will be directly comparable. This will afford the opportunity to evaluate the effectiveness of programs to improve X-ray practice and reduce unnecessary exposure. The 1970 study will also aid in establishing guidelines for future programs.

The new study is being conducted in three phases:

1. A household interview survey to obtain the X-ray visit experience of a representative sample of the U.S. population. This phase will run from April 13 through October 12 and will cover about 20,000 households and 65,000 persons.

2. A followup questionnaire to obtain examination data from X-ray facilities identified in the household survey. From May through December, approximately

5,000 facilities will be asked to supply these details. Authorization to request the information will be obtained in advance from household respondents.

3. An X-ray equipment survey to provide physical measurements in a selected subsample of X-ray facilities. This phase will be conducted by specially trained State and Federal radiological health personnel.

Based on data obtained during the household and facility surveys, a descriptive analysis of the population's X-ray experience in 1970 will be prepared. The information, which will be categorized by pertinent demographic and facility characteristics, will include estimates of numbers and rates for (a) persons X-rayed, (b) X-ray visits, and (c) X-ray examinations and exposures.

Estimates of gonadal and genetically significant doses will be derived from the study findings by applying mathematical models developed at the Johns Hopkins and Emory Universities in collaboration with the 1964 study. It is also planned to extend these data into dose estimates for other selected body organs through the use of related research results.

Since this study is based on a small representative sample, the cooperation of each practitioner contacted in the followup phase is essential to meet the study objectives. All information pertaining to individual patients, practitioners, and facilities will be treated confidentially. Only statistical summaries will be made available for publication.

Additional information about the survey may be obtained from the Bureau of Radiological Health, 1901 Chapman Avenue, Rockville, Md. 20852.